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Water content in the SW USA mantle lithosphere: FTIR analysis of Dish Hill and Kilbourne Hole pyroxenites

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Abstract:
Kilbourne Hole (NM, USA) and Dish Hill (CA, USA) mantle xenoliths sample continental mantle in two different tectonic settings. Kilbourne Hole (KH) is located in the Rio Grande rift. Dish Hill (DH) is located in the southern Mojave province, an area potentially affected by subduction of the Farallon plate beneath North America [1]. FTIR analyses were obtained on well characterized pyroxenite, dunite and wehrlite xenoliths, thought to represent crystallized melts at mantle depths. PUM normalized REE patterns of the KH bulk-rocks are slightly LREE enriched and consistent with those of liquids generated by < 5% melting of a spinel peridotite source [2]. Clinopyroxenes contain from 272 to 313 ppm weight H_2O similar to the lower limit of KH peridotite clinopyroxenes (250-530 ppm H_2O, [3]). This is unexpected as crystallized melts like pyroxenites should concentrate water more than residual mantle-like peridotites, given that H is incompatible. PUM normalized bulk REE of the DH pyroxenites are characterized by flat to LREE depleted REE profiles consistent with > 6% melting of a spinel peridotite source. Pyroxenite pyroxenes have no detectable water but one DH wehrlite, which bulk-rock is LREE enriched, has 4 ppm H_2O in orthopyroxene and <1ppm in clinopyroxene. The DH pyroxenites may thus come from a dry mantle source, potentially unaffected by the subduction of the Farallon plate. These water-poor melts either originated from shallow oceanic lithosphere overlaying the Farallon slab [4] or from continental mantle formed > 2 Ga [5]. The Farallon subduction appears to have enriched in water the southwestern United States lithospheric mantle further east than DH, beneath the Colorado plateau [6]. [1] Atwater, 1970 Tectonophysics 31, 145-165. [2] Shaw, 2000 CM 38, 1041-1064. [3] Schaffer et al, 2013 AGU Fall Meeting. [4] Luffi et al, 2009 JGR 114, 1-36. [5] Armytage et al, 2013 GCA 137, 113-133. [6] Li et al, 2008 JGR 113, 1-22.

Back to: Volatiles and Earth's mantle processes

<< Previous Abstract | Next Abstract >>

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